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Reply to Attn of: 423

August 28, 1992

TO: Distribution

FROM: 423/Earth Science Data and Information System
Instrument Science Software Manager

SUBJECT: Guidelines for Software and Data Management Plan

The Earth Science Data and Information System (ESDIS) Project has responsibility for the management of science software being developed by many Earth Observing System (EOS) investigators. ESDIS Project is also required to document the Project software management approach for all software, including science software, in the ESDIS Project Software Management Plan (SMP).

The ESDIS Project needs to understand how each instrument team plans to develop science software to prepare the SMP, and expects the team plan will provide the framework for the relationship between the instrument team and the ESDIS Project.

To assist the instrument teams in their preparation of the Software and Data Management Plan (S&DMP), the ESDIS Project has prepared a guidelines paper describing the kinds of information needed to manage the implementation and eventual operation of instrument science software. The guidelines paper provides suggested contents for the S&DMP. The ESDIS Project will need the first version of the S&DMPs for the initial Annual Reviews, expected to begin in the second quarter of FY93.

The ESDIS Project has started a dialogue with instrument science software developers and science community advisors regarding the S&DMP. Earlier versions of the guidelines paper have been given to several instrument team members for comment and to assist them in their planning. A presentation was scheduled for the EOS Advisory Panel (EAP) meeting in Keystone to describe the suggested contents of the S&DMP, but due to the length of the agenda and lack of time, the presentation was not made. However, copies of the guidelines paper were made available to EAP members.

The ESDIS Project is providing the enclosed copy of the latest version of the S&DMP guidelines paper to the EOS AM and the PM instrument teams.

Comments are requested by September 30, and may be sent to Stan Scott via email to stan@eosscott.gsfc.nasa.gov. or SRSCOTT on GSFCMail.

Stan Scott

Stanley Scott

Enclosure

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SOFTWARE AND DATA MANAGEMENT PLAN

INTRODUCTION

Planning is indispensable for organizing the work that will be put into the software that generates and supports the production of the Standard Data Products (SDPs). It is for this reason that each of the Science Teams is required by their Statement of Work to generate a Software and Data Management Plan (S&DMP). This paper provides the Earth Sciences Data and Information System Project's (ESDISP) guidance on the plan's content from the software management perspective (a strawman outline is provided at the end of the paper); but, the ESDISP is relying on the Science Team to bring forth the plan that will work for them. The ESDISP will review and approve each team's plan, and will use them to further develop its own planning. The Science Team's approved plan will then become the basis for the technical and management relationships between the ESDISP and the Science Team. But those relationships are only one aspect of the plan; perhaps more importantly, it will describe the relationships among the team's members. The ESDISP regards the S&DMP as a living document - one that will continue to develop over the course of the science and algorithm development effort.

PLANNING INFORMATION

The following information is intended to support the Science Team's planning, and provides indications of the information that should be part of the Science Team's S&DMP.

Scope:

The S&DMP should cover work supported by Science Algorithm funding. It should cover the work related to all Science Team software that will reside in the Product Generation System (PGS) of the Distributed Active Archive Center (DAAC), the Science Computing Facility (SCF), the Instrument Control Facility (ICF),

and the Instrument Support Terminals (ISTs). The ESDISP's principal interest is the plan for the software that will be delivered to the project for incorporation into the operational system. The project has a secondary interest in the SCF software that the Science Team will use to evaluate the quality of the SDPs, and to develop new SDPs. Beyond those two areas of SCF software, the plan should describe in a general way any substantial software related SCF activities (e.g., generation of a major test data set). The plan should cover all activities pre- and post-launch. It is expected that the first version will focus on the early stages of the work (FY'94 and '95), although it is important to anticipate future work - at least to the extent of describing what must be done, and identifying the roles and responsibilities of the Science Team and the ESDISP.

Products:

The ESDISP expects to receive three versions of the science software that will execute in the PGS or ICF: "beta", V1 and V2.

The beta version should exercise the PGS Toolkit interface, demonstrate its portability from the SCF environment to the PGS environment, demonstrate its operational characteristics, and provide for an initial assessment of the computational resource consumption.

V1 should provide all of the major functional capabilities, and should support a full assessment of the computational resource consumption. It should be capable of running in an "operational" environment using the Team's test data input.

V2 is launch ready, complete and verified, operational software system.

With each delivery of software, ESDISP expects to receive a version description document, an operator's guide, and a user's

guide. The ESDISP also expects that there will be a series of post-launch updates to the science software.

Processes:

1 The life-cycle:

The plan should describe the life-cycle of the Science Team's software and how the components from each of the team members fit into it. The life-cycle should identify the processes, activities, events, and rules that are employed by the Science Team in the course of the data engineering, and the science software creation and maintenance. It should also include the activities related to monitoring the quality of the Standard Data Products generated by the operational system. Concepts for a science software life-cycle are presented in another Handbook Paper, "The Science Software Life-cycle."

From the ESDISP's perspective there are several important events: establishment of the definitive specification of the Standard Data Products, delivery of each of the versions (but most importantly V2), and successful completion of the Operations Readiness Review (ORR). The preparation for the ORR is primarily the responsibility of the ESDISP but requires support by the Science Teams. The ESDISP must show that the science software has been fully integrated into the EOSDIS Core System (ECS) PGS (and ICF, if appropriate), and that its operability has been demonstrated; the Science Teams support this activity and must show that supporting components in the SCF are ready to support operations.

2 Delivery, integration, and acceptance:

The Science Teams will port their science software (together with data and procedures needed to generate and check-out the executable program(s)) to the PGS that will be its execution environment. The science teams will participate

in the PGS integration and check-out. Upon successful demonstration of the team level integration and check-out, the science software will be accepted and placed under ESDISP configuration control.

3 Validation:

The plan should describe in a general way (or reference other documentation that describes) how the Science Team will perform the validation of the Standard Data Products.

Roles and Responsibilities Overview:

The IWG is responsible for assuring that the Standard Data Products meet the science needs of the EOS Program. The Science Teams produce the science software and are responsible for assuring the validity of the resultant Standard Data Products. The ESDISP is responsible for the environment in which the science software executes, and for operations in the PGS that result in the production of the Standard Data Products.

Reviews and Reports:

- 1 The plan should provide for an annual technical status review; and quarterly technical reports as well as monthly exception reports of development that affect agreements between the Team and the ESDISP.
- 2 The plan should provide for quarterly financial reports except if the annual funding is greater than \$500,000, in which case the reports should be made monthly.

The following reviews may be conducted on different occasions for different components, but related components should be reviewed at the same time.

- 3 The plan should provide for a requirements review. This should comprise a review of the description of the Standard Data Products and the data interface specifications.
- 4 The plan should provide for a design review. This should comprise a review for V2 of the complete design of the data products, the product generation software (including calibration data sets), and the integration and verification procedures.
- 5 The plan should provide for an acceptance and integration readiness review. This should comprise a review for V2 of the results of the Team's integration and verification effort, the delivery (into the DAAC PGS) process, and the check-out performed by the ESDISP.

Schedules:

1 Resources:

- A PGS Toolkit Specification is planned to be available 1/94.
- B PGS Toolkit (SCF version) is planned to be made available in three versions: a "beta" version on 1/95, V1 on 1/96, and V2 on 1/97.
- C PGS Toolkit (DAAC version) is planned to be made available in three versions: a "beta" version on 6/95, V1 on 6/96, and V2 on 6/97.

All schedule sensitivities to the availability of these resources should be identified in the plan.

2 Reviews:

- A The requirements review should be successfully completed 60 months before launch.

- B The design review should be successfully completed not later than 18 months before launch.
- C The acceptance and integration readiness review should be successfully completed not later than 9 months before launch.

The ESDISP expects that these reviews will be planned to be conducted at one of the annual technical reviews.

3 Deliveries:

- A The beta version should be delivered between 42 and 24 months before launch.
- B V1 should be delivered 24 months before launch.
- C V2 should be delivered 12 months before launch.

Activities:

1 PGS Toolkit Specification

A key activity that requires Science Team support is the development of the PGS Toolkit specification. The ESDISP has initiated a study, the first results of which appear as a paper in the first release of the Science Software Developer's Handbook. Review and comment of this paper and successive versions will be important to the ECS contractor when they start work. The ECS contractor will bring out versions of the specification beginning in the spring of 1993; intensive review of these specifications should be a high priority for the Science Team.

2 Estimation of the computing resource consumption requirements

Accurately estimating the science software computing resource requirements on the PGS will be a challenge. The ESDISP will place emphasis on obtaining good estimates and identifying risk areas. Special effort should be made to incorporate components that will be useful in measuring the anticipated computing resources in the beta and V1 versions. The plan should include other techniques that may be used to address this challenge.

3 Data interface specification

These activities include the data interfaces for the Level 0 data sets supplied by the EOSDIS, the input requirements for higher level Standard Data Product generation algorithms upon lower level Standard Data Products, and the requirements for Correlative and Ancillary data.

4 Configuration management within the SCF(s) and IST(s)

Configuration management within the SCF(s) and IST(s), if applicable, is the responsibility of the Science Team; the S&DMP should address the way that this function will be performed for the software, and data within these environments, especially for those components that will be delivered to the ESDISP and those that will be used to support on-going operations.

5 V0 DAAC activities

The plan should provide for participation in the science user groups associated with the DAACs that have been established as part of the V0 effort. These groups will be important for the development and review of capabilities available at the DAACs. Other discipline related efforts will be coordinated by the DAACs as well; for example, there is an ongoing effort to study the data structures and formats and supporting tools for the Standard Data Products.

6 The IWG Data Panel and the ESDISP Focus Teams

The plan should provide for participation in the IWG Advisory Panel, and ESDISP Focus Teams (FTs) such as the Data Production Team.

Risks:

The plan should contain a section (or sections) that addresses risks that can be identified now, and how they will be dealt with, as well as an approach to identifying risks as they may appear in the course of development. The ESDISP has identified a number of risk areas that the Science Teams may wish to address in their plan:

- 1 assure that the requirements for and relationships among the Standard Data Products are sufficiently well defined to provide a basis for the science software development
- 2 assure that the PGS Toolkit will be effective in facilitating the integration of the science software into the PGS without significant problems
- 3 identify in a timely manner the science software computing resource requirements
- 4 assure that there will be sufficient time between the delivery of V1 and V2 to allow incorporation of lessons learned from exercise of V1 in the PGS into V2
- 5 assure that there are sufficient resources to develop the science software related to the Standard Data Products
- 6 assure that the science software related to the Standard Data Products can be cost-effectively maintained (For example, a Science Team may develop guidelines that encourage coding and documentation practices that yield maintainable products.)

RELATED ESDISP ACTIVITIES:

1 EOSDIS procurements

The ESDISP will be responsible for all matters related to the science software in the process of NASA's acquisition of the EOSDIS and related communications and information systems and services. In particular the ESDISP will lead the effort to define the Science Software interfaces, especially with the PGS Toolkit.

2 Configuration management of the science software within the PGS and ICF

Configuration management of the science software within the PGS and ICF (if appropriate) is the responsibility of the ESDISP; the ESDISP will define and operate the reporting and change control procedures for these environments.

3 Performance and computing resource consumption assessments

The ESDISP will perform assessments and make recommendations to the developers of the science software related to the consumption of computing resources.

4 Software Quality Assessments

The ESDISP has identified five aspects of the quality of the science software that it will be concerned with: portability, maintainability, operability, reusability, and efficiency with respect to consumption of computing resources. The ESDISP will develop metrics, perform assessments, and make recommendations related to these quality aspects.

5 The Science Software Developer's Handbook

The ESDISP will bring out, in a series of releases, a handbook for the participants in the science software development and

operations effort. It will contain information on tasks, approaches, tools, and practices relevant to the work of the Science Teams. The Team's plan could provide for the preparation of papers to be included in the handbook.

6 The ESDISP Laboratory

The ESDISP will develop a computer "lab" that will be used to:

- A check-out interfaces, especially the PGS Toolkit's capabilities provided to the science software
- B carry out prototyping in support of science software development
- C carry out performance and computing resource consumption experiments
- D host a library of reusable software components
- E check-out ESDISP recommendations and guidelines for the Science Teams

7 The Newsletter: The EOSDIS Science Data Processor

The ESDISP will publish a newsletter for participants in science software development and operations that will keep them abreast of the activities of EOSDIS; and, since submission of articles and notes is open (and encouraged) to everyone it provides a forum that they can use to communicate their ideas and experiences. (Note that the Earth Observer newsletter, produced by the EOS Project Scientist, contains information related to EOS science.)

OTHER S&DMP CONTENTS

1 Science Studies

In spite of all of the business associated with the software for the production of the Standard Data Products, the plan must not lose sight of the most important work of the project - the conduct of the scientific studies that are the basis for those products. The plan should identify those efforts the Team will undertake and how communication and coordination among related studies will be accomplished.

2 Classification of the Work Activities

The plan should classify the different kinds of work activities, including items for:

- A) science activities
- B) technical coordination among team members, between teams, and with the ESDISP (including participation in the IWG, and ESDISP sponsored activities)
- C) engineering and development activities for the major data and software components
- D) assurance activities, including team reviews, and team level integration and verification
- E) support for ESDISP level integration and check-out
- F) support for PGS operations
- G) support for SCF operations
- H) support for software maintenance and update
- I) related team level management

3 Budgets

The plan should provide budgets (under a separate cover, if desired) that show the allocation of resources to the work activities for each FY.

4 Organization

The plan should show the organization of the team, describe their roles and responsibilities, the activities that they will perform, and their participation in the products that are produced. In addition the ESDISP would like each team to identify an individual with authority to represent the team to the ESDISP in matters covered by the plan.

5 Quality

The plan should address the aspects of quality from the perspective of the Science Team, and describe how the team will assess the quality of the science software and the products that it produces. The plan may elaborate on those identified by the ESDISP (see the section on ESDISP activities: software quality assessments, above), and may identify activities, approaches, and methods for quality assessment.

6 Reuse Approach:

The plan should describe processes and/or activities specific for incorporation of heritage or other reused software.

STRAWMAN SOFTWARE AND DATA MANAGEMENT PLAN OUTLINE

1 Introduction

A description of this version of the document, and the current plan for the document

2 Related Documents

Identification of documents that influence the content or form of this version, or documents that are directly relevant to understanding this version. (Include a description of the relationship between this document and the SCF Plan.)

3 Overview

3.1 Descriptions of the Data Products and the Science Software

3.1.1 A description of the Data Products

Identify each of the Standard and Special Data Products with a brief description of each, specification of when they are planned to be available, and identification of who is responsible for their generation and on-going operational support. For the Special Data Products identify the SCF(s) and/or DAACs in which they are planned to be available.

3.1.2 A description of the Science Software

Identify overall structure of the Team's software, and the components that will be contributed by each Team Member, and relate these to the Data Products.

3.2 A description of the Science Team

A description of the organization adopted by the Team,
and the roles and responsibilities of the participants.

4 Technical Approach

4.1 A description of the life-cycle: the overall process and the
development products, such as design descriptions

4.2 An identification of the key schedule milestones

4.3 An identification of technical risks, and risk identification
and management activities

4.4 A description of the data engineering activities, especially
those related to the elaboration and refinement of the
Standard Data Product descriptions.

4.5 A description of the scientific, technical coordination, and
software engineering activities: science, dependencies,
interfaces, standards, computing resource consumption
estimation and measurement, problem resolution,
configuration management, operations planning, and
IWG Panel and ESDISP FT participation

4.6 A description of the science software development or
reuse activities

4.7 A description of the integration, delivery, and installation
activities

4.8 A description of the operations support activities

4.9 A description of the science software maintenance
activities

5 Assurance Approach

- 5.1 A description of quality objectives, the approach, and the plan for quality assurance, and related products, such as quality assessments
- 5.2 A description of the methods, techniques, and tools that support the development of quality software
- 5.3 A description of the testing and other methods of software verification and validation
- 5.4 A description of the approach the Team will use to validate the Standard Data Products
- 5.5 A description of the approach the Team will use to monitor the quality of the Standard Data Products during operations

6 Management Approach

- 6.1 A description of the planning process and related products, such as plans and status reports
- 6.2 An identification of management risks, and risk identification and management activities
- 6.3 A scheme for the work activities
- 6.4 A description of the available resources (including budgets), and how they are applied to accomplish the work
- 6.5 A description of the monitoring mechanisms, and the reports that will be made

